

S-I ELECTRONICS, INCORPORATED

103 PARK AVENUE, NUTLEY, NEW JERSEY 07110 • PHONE (201) 667-0055



A SUBSIDIARY OF TECHNICAL MEASUREMENT CORPORATION

JULY 19, 1966

SYSTEMS CONSULTANT  
Box 1546  
POUGHKEEPSIE  
NEW YORK 12603

DEAR MR. NELSON:

Here is the technical literature you requested for our COMPUTER COMPATIBLE Digital Magnetic Tape Transports.

The DT-03 Series Tape Drives have been tested under MIL-E-5400 and MIL-I-26600 - - - - THEY ARE THE ONLY tape drives available which are fully qualified for rugged environmental operation - - - - Airborne, Shipboard, and Vehicular applications.

The advanced design of these units have resulted in the compilation of data and many hours of reliable operation under the most severe environments.

We sincerely appreciate your interest in our products.

Very truly yours,

S-I ELECTRONICS, INC.

  
IRWIN B. GOLDBERG  
MARKETING MANAGER

**DIGITAL MAGNETIC  
TAPE TRANSPORTS  
FOR RUGGED  
ENVIRONMENTS**



**Completely Computer Compatible**

•

**Fully Qualified  
Under Military Specifications**

**S-I**  
**—**

A SUBSIDIARY OF  
TECHNICAL MEASUREMENT CORPORATION





# S-I

**ELECTRONICS, INC.**

manufactures high quality, special purpose magnetic memory equipment. These include digital and analog tape transports, memory drums, magnetic heads, and integrated recording systems.

Our objective is to provide our customers with a source for special memory devices, built to rigid specifications and designed to fill particular requirements.

These instruments and components are manufactured in accordance with strict quality standards. Their design provides for long, dependable operation while withstanding the most adverse operating conditions.

The reliability of S-I's transports have been demonstrated many times over during thousands of hours of trouble-free operation in projects such as the FAA SAFI (Semi-Automatic Flight Inspection) System and the Air Force air weather program. In both of these programs, S-I's tape transports have proven themselves while operating under extremely rigorous conditions for extended periods.

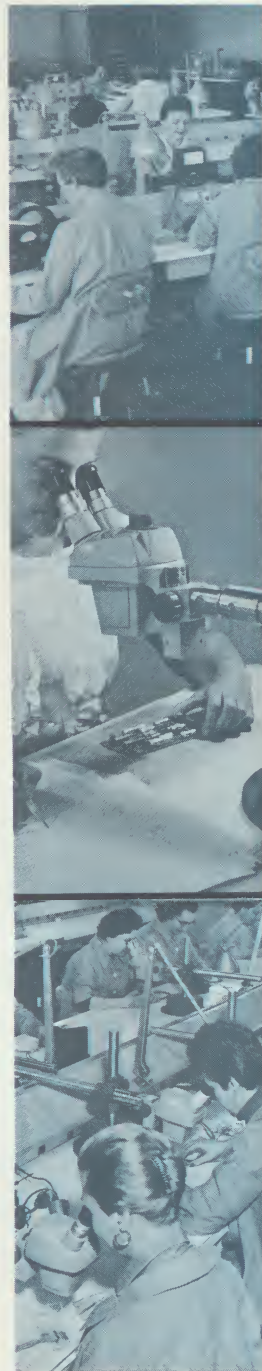
## RESEARCH AND ENGINEERING

An intense research program is directed at the investigation of all phases and methods of recording and reproduction. This program has led to increased reliability of our equipment and components and, in some cases, development of better components and methods. Qualified engineers with many years experience can provide practical solutions to your system problems. These men are, of necessity, constantly developing approaches to new challenges not imagined just a few years ago.

## PRODUCTION AND QUALITY CONTROL

S-I production facilities utilize the care, equipment, and personnel so necessary in producing precision electro-mechanical equipment. Trained technicians, each skilled in their specialty, assemble the units with care. Finally, supervision of each production step assures the ultimate user that long years of dependable service can be expected.

Strict quality control procedures and regulations result in the production of equipment that will meet or exceed specifications every time. Each instrument must exceed dozens of quality control standards before it leaves the factory. Tests and checks are performed using only the best equipment. Where applicable, compliance with military specifications is assured in accordance with MIL-Q-9858.



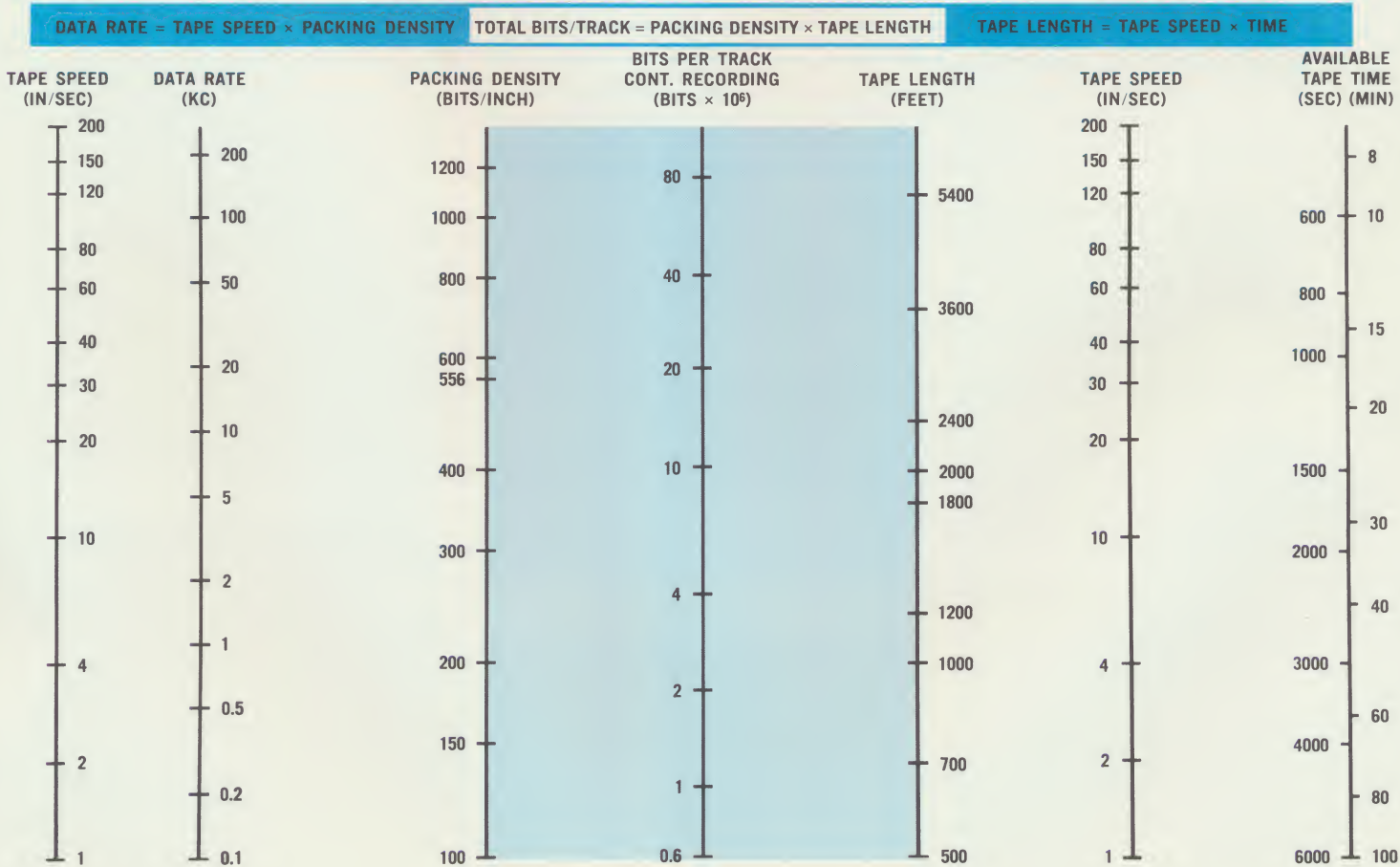


technical data

There are a variety of modes or formats used in recording digital data and some confusion exists in their identification. As an attempt to clarify this situation, we have listed below the most common formats along with their important characteristics.

FORMAT	WAVEFORM	DESCRIPTION
RZ		Positive current pulse for "1", negative pulse for "0". Zero current between bits. Requires two flux reversals per bit and, therefore, has limited packing density. Will not erase previously recorded data. Playback signals are lower than other forms due to smaller values of flux change.
RB		Similar to RZ but utilizes positive current pulse for "1" and steady current level in opposite direction for "0" and between bits. Limitation same as RZ, but will erase previously recorded data.
NRZ		Individual writing current pulses spread out in time so that they occupy a full bit cell. Maximum of one flux reversal bit. Some difficulty in reading long runs of 1's or 0's.
NRZI		Similar to NRZ, but alternates the direction of current flow each time a "1" is to be recorded, and allows current to flow in original direction for "0". Most common form of digital recording. Flux reversals for "1" simplifies detection circuits and increases reliability.
Phase Modulation		One or two flux changes per bit, "0" recorded by positive flux change in 2nd half of bit time, "1" recorded by negative flux change in 2nd half of bit time. First half of bit time used to set flux state so that proper sense of flux change can be achieved. Higher reading reliability at high packing densities. Requires synchronizing clock.

In selecting the basic characteristics for tape transports, we have found that certain inter-relationships require repetitive solutions. The most common of these are presented below as three independent nomographs. Their use should help define requirements for tape speed, packing density, and tape length.



## dt-03 series



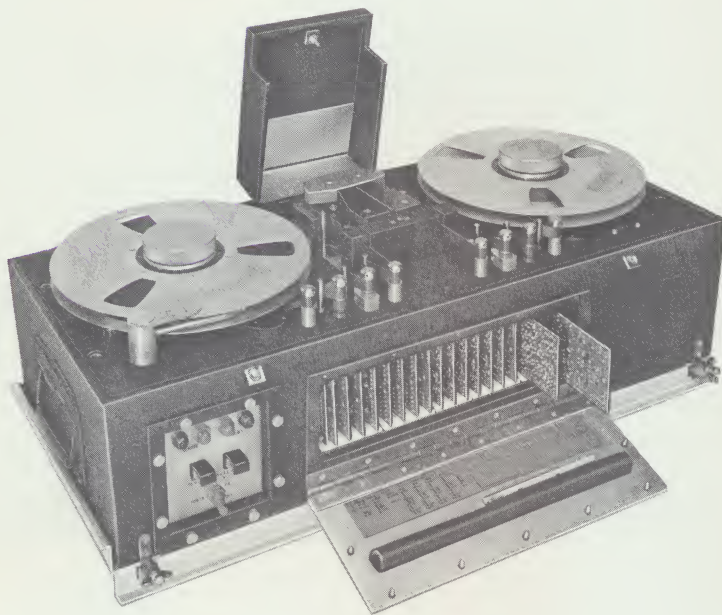
- **Data processing in airborne, shipboard, and vehicular environments.**
- **Qualified under MIL-E-5400.**
- **Fully computer-compatible.**
- **Light weight - only 95 pounds.**
- **Compact - less than 2.5 cubic feet.**

## mobile digital tape transport

The S-I DT-03 Mobile Tape Transports are high-performance Digital Magnetic Tape Transports which provide complete computer-compatibility under the severest environmental conditions. They are designed both to record and to reproduce intelligence according to all standard formats. They utilize standard 10 $\frac{1}{2}$ " reels of  $\frac{1}{2}$ " or 1" tape, standard computer formats and interfaces, and feature a start/stop time of less than 5 milliseconds. All electronics, including the servo system, are completely transistorized. The DT-03 series has been fully qualified under MIL-E-5400, MIL-I-26600, and other environmental specifications.

The use of computers for the reduction and analysis of data has become standard practice throughout modern industry. Until recently, it has often been the practice to collect and record "off-line" data in analog form due to the lack of digital tape transports sufficiently rugged for field use. This required later playback of the data, conversion to digital format, and re-recording on a medium acceptable to the computer. The DT-03 series makes possible the direct recording of field data in digital form, regardless of the environment. The extra steps of analog recording and conversion are eliminated and results are obtained faster and more accurately.

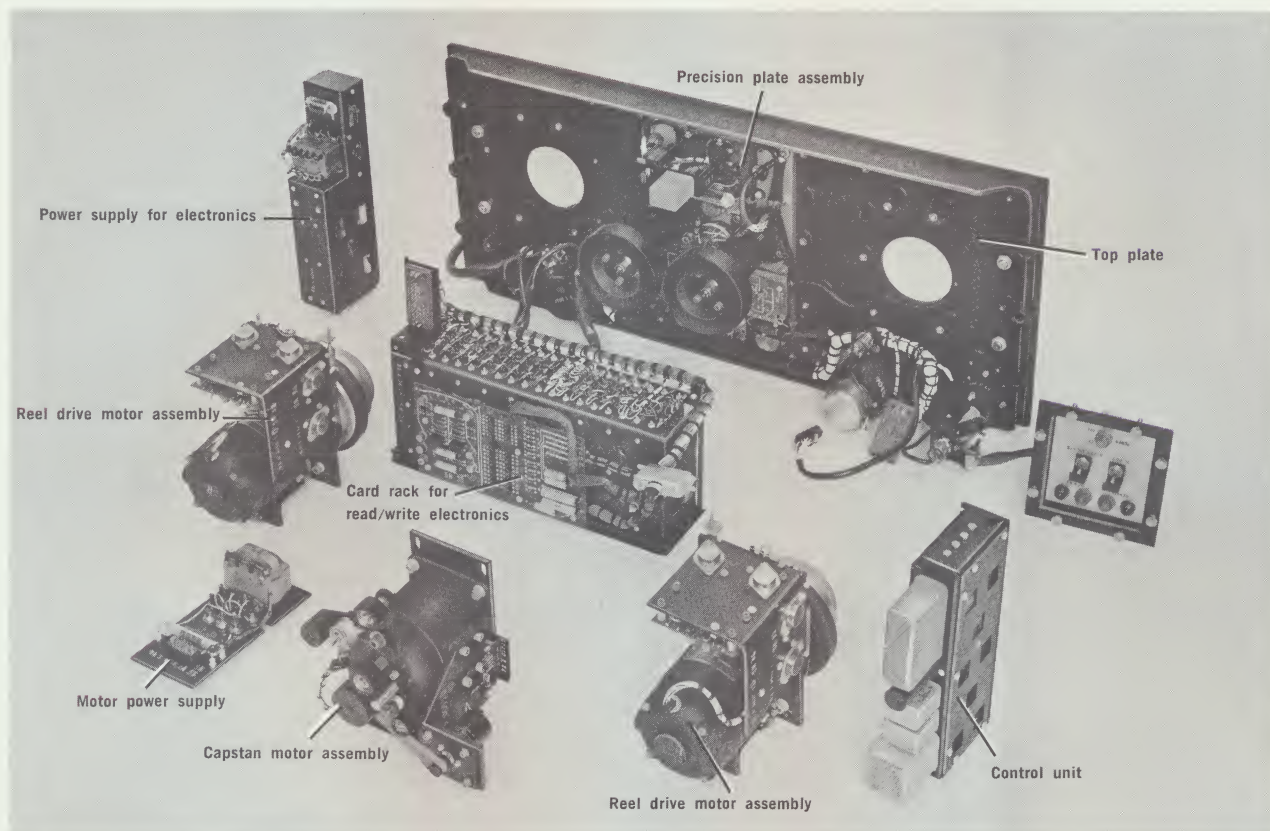
Similarly, where it is desired to extract digital information previously recorded on magnetic tape for such purposes as data or program input to airborne computers, auto pilots, test sequence controllers, communications links during open time, etc., the DT-03 Tape Transport can be used to read these tapes in flight. Reading can be accomplished either continuously or on a record by record basis.





## modular construction

The DT-03 Tape Transport is constructed from a selection of standard modules, each an integral sub-assembly. This construction allows a wide variety of optional features and provides ready conversion to meet any special requirements. It also facilitates maintenance and parts replacement. A module can be replaced in minutes merely by unplugging it and removing the mounting screws. Modules are interchangeable between transports and need not be custom-fitted. Spare parts and maintenance time have been reduced to a minimum.



### dc drive motors

The capstan motor and the reel drive motors operate through DC servo systems. The capstan motor is a DC motor whose speed is sensed by a temperature-compensated tachometer generator, the output of which is compared to a fixed DC reference voltage in a differential amplifier. The output of this amplifier is used to hold the speed of the capstan motor constant regardless of load, power supply, and environmental conditions. The speed can be set to any desired value merely by switching the DC reference voltage. No gear or belt changes are required. No fixed speed ratio limitations exist.

The reel drive motors are split-field, series wound DC motors whose torque and direction are controlled by the positions of the tape storage arms. The output signal from the tape storage arm potentiometer is amplified by a servo amplifier and is used to control the torque motor drive amplifier. The overall system provides a stable, quick-acting tape drive system independent of environment.

### all solid-state electronics

"Read" and "Write" amplifiers, servo systems, and control circuits are all transistorized. No tubes are used for any functions. This design feature provides light weight and high reliability as well as low power requirements.

### completely self contained

A completely computer-compatible instrument is contained in a single package. Within the instrument, but readily available, are "Read" and "Write" amplifiers, remote control circuits, local controls — everything required for direct connection to a computer or data acquisition system.

### reliable

The DT-03 series has been thoroughly field tested in a wide range of applications over a period of several years. It has also been fully qualified under MIL-E-5400 and other environmental specifications. Vacuum columns and other environmentally sensitive components have been eliminated, with no decrease in performance.

# dt - 03 series specifications

Tape Motion	Standard	Standard Modifications
Speed	Any speed between 0.5 and 37.5 ips can be supplied as standard	Speed can be increased readily to 75 ips for continuous operation.  The maximum speed for start-stop operation can be increased to 75 ips as a standard modification. All other specifications will apply except as noted below.
Speed Selection	Single speed within range specified above	Multiple speeds within the range specified above are readily available. The speeds need not be related in any fixed ratios. Continuously variable, remotely or internally controllable speeds are also available.
Direction	Unidirectional	Read and/or write in both directions can be supplied if desired.
Speed Tolerance	$\pm 3\%$	See Note 1
Wow and Flutter	$\pm 2\%$	See Note 1
Start Time	5 milliseconds	See Note 1
Stop Time	5 milliseconds	See Note 1
High Speed Wind	Bidirectional, 1½ minutes for 2400' of tape	
Program Limitations	The tape drive system will accept any sequence of commands as long as the start/stop time limitations are not exceeded. Interlocking circuitry prevents simultaneous drive in both directions.	
		NOTE 1: Closer tolerances available where required.

Tape & Reels	Standard	Standard Modifications
Tape Width	½" (0.498 $\pm$ .002")	1", ¾" and other widths also available.
Reel Type	10½" precision NARTB or IBM	Hubs for RCA, RRU and other types can also be supplied.
Reel Hubs	Quick action, permanently-retained NARTB or IBM	As required by reel type.
Tape Capacity	2400' of 1.5 mil tape	Dependent on thickness of tape.
Recording Method	NRZI compatible with IBM	Interchangeable heads and write amplifiers assure compatibility with all major computer formats.
Packing Density	200 bits/inch	556 and 800 bits/inch as well as other densities also available.
Tracks	7	8 also available on ½" tape, up to 21 available on 1" tape.
Track Spacing	0.070 $\pm$ .001"	As required by format.
Track Width	0.048 $\pm$ .001"	As required by format.
Dynamic Skew	Less than 12 microseconds at 30 ips	
Gap Scatter	50 microinches max.	
Head Type	Single-section, half-shell with full trough guide	

Data Electronics	Standard	Standard Modifications
Mode of Operation	Write and Read	Write only, read only, or read-after-write designs can be supplied to meet specific requirements.
Write Circuitry	Two write amplifiers per plug-in card, utilizing NRZI method for saturation recording. Input can be level, pulse, or NRZI	NRZ, RZ, RB or phase-modulation available.



Data Electronics	Standard	Standard Modifications
Read Circuitry	Peak detection read circuit, one per plug-in card. NRZI, or Pulse output.	As required by format.
Input & Output Levels	"0" = 0v. $\pm$ 0, $\pm$ 2v "1" = $\pm$ 12v. $\pm$ 2v	As required by format.
Controls & Indicators	Standard	Standard Modifications
Local Controls	Power Fast forward Fast rewind Stop	Write-enable ring. Additional controls as required.
Remote Controls	Forward Reverse Write Write-enable Read Fast wind Fast rewind All functions controlled with 0 volts "off" and $\pm$ 12 volts "on"	As required by application.
Local Indicators	Power	Other levels or control signals are available as required.
Remote Indicators	Write acknowledge Read acknowledge Forward acknowledge Reverse acknowledge Rewind acknowledge End of tape or tape break % Tape remaining Indicators actuated through N. O. contacts	
Power Requirements	Standard	Standard Modifications
Voltage	115 V, 400 cps, 3 phase	400 cps, single phase, 60 cps single phase, or 28VDC are available as standard options. Others on special order.
Power	75 VA — Normal Operation 300 VA — Transient during start/stop	
Physical	Standard	Standard Modifications
Size	28" x 11½" x 9¾" including shock mount base.	Standard 19" relay rack and mounting for special applications available as required.
Weight	95 pounds	
Connectors	Power — MS 3102R20-21P Control — MS 3102R28-21P Signal — MS 3102R28-12P	As required.
Cover	Dust proof cover allows full access to tape reels, head, etc. for easy, straight-through loading. Separate door for access to plug-in electronics	
Environmental	Standard	Standard Modifications
Temperature	$\pm$ 55°C to $\pm$ 55°C @ 50,000 ft. $\pm$ 55°C to 71°C @ sea level	Other environmental specifications as required for specific applications.
Altitude	Sea level to 50,000'	
Vibration	Curve 1, MIL-T-5422E	
Shock	30g, 11 msec (crash safety)	
Humidity	0 to 95% R.H.	
Explosion Proof	Per MIL-E-5272C	
RF Interference	MIL-I-26600	

## OPTIONAL ACCESSORIES

**Photo cell load point and end of tape sensing.** Either through reflective strips or transparent tape windows.

**File protect ring.** Detects presence, or absence, of plastic insert ring used on IBM reels. Provides contact closure for external leads.

**Parity check character generator and/or detector.** Circuitry to provide an even or odd parity check

character on one channel when in the "write" mode, or to check parity in the "read" mode can be incorporated within the transport.

**Special Circuitry.** Special circuitry of various types can be included, such as track switching and tape direction reversal at the end of each pass of the tape, tape direction reversal and start/stop at pre-determined points, serial and parallel format conversion, skew correction, etc.





## **dt-03 series — rack mounted**

The DT-03 Series can be supplied in a hinged frame for mounting in a standard 19" relay rack or cabinet. The instrument is mounted vertically in a rugged frame hinged to permit full access for easy maintenance. All performance specifications are the same as for the horizontally-mounted instrument.

Over-all dimensions for the rack-mount are 35" high, 19" wide, and 9-3/4" deep.

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